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THE EVOLVING ROLE OF EMERGENCY MEDICAL SERVICES IN SACRAMENTO, CA

by

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December 2017

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Due to the Affordable Care Act, millions of Americans now covered with health insurance have found it increasingly difficult to find primary care physicians. The demand for health care has exceeded the capacity of the current system to supply it. People have turned to emergency medical services to receive care for their chronic illness and non-acute medical problems instead of dealing with the long wait times at clinics or unavailability of primary care physicians. This transition to low acuity care occupies a large portion of the emergency response system and leaves communities with very limited emergency response resources. Several cities have attempted to increase the availability of their emergency response resources by matching the type of care that is being requested through the nation's 9-1-1 system. Mid-level nurse practitioners and behavioral health specialists paired with paramedics can provide a broader set of solutions instead of transporting all patients to a hospital emergency department and at the same time allow traditional emergency response ambulances to remain available. Measuring the performance of these new programs and tailoring them to meet the precise needs of a community can enhance the resilience of emergency resources and improve the nation's homeland security.

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THE EVOLVING ROLE OF EMERGENCY MEDICAL SERVICES IN SACRAMENTO, CA

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ABSTRACT

Due to the Affordable Care Act, millions of Americans now covered with health insurance have found it increasingly difficult to find primary care physicians. The demand for health care has exceeded the capacity of the current system to supply it. People have turned to emergency medical services to receive care for their chronic illness and non-acute medical problems instead of dealing with the long wait times at clinics or unavailability of primary care physicians. This transition to low acuity care occupies a large portion of the emergency response system and leaves communities with very limited emergency response resources. Several cities have attempted to increase the availability of their emergency response resources by matching the type of care that is being requested through the nation's 9-1-1 system. Mid-level nurse practitioners and behavioral health specialists paired with paramedics can provide a broader set of solutions instead of transporting all patients to a hospital emergency department and at the same time allow traditional emergency response ambulances to remain available. Measuring the performance of these new programs and tailoring them to meet the precise needs of a community can enhance the resilience of emergency resources and improve the nation's homeland security.

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LIST OF ACRONYMS AND ABBREVIATIONS

ACA	Affordable Care Act
ACO	accountable care organization
AHC	affordable healthcare
BHRU	behavioral health response unit
CCRU	community care response unit
EMD	emergency medical dispatching
EMS	emergency medical services
EMSA	Emergency Medical Services Authority
ED	emergency department
HIE	health information exchange
JPA	joint powers authority
LEMSA	Local Emergency Medical Services Authority
MIH	mobile integrated health
MCI	multicasualty incident
PHI	protected health information
SRFECC	Sacramento Regional Fire/EMS Communications Center
TRV	transitional response vehicle
UHU	unit hour utilization
VBP	value based purchasing

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EXECUTIVE SUMMARY

Due to the Affordable Care Act, millions of Americans now covered with health insurance have found it increasingly difficult to find primary care physicians.[1] Wait times for patient appointments stretch out for months. Quite literally, the demand for health care has exceeded the capacity of the current system to supply it. Consequently, more and more people, particularly those seeking care for chronic illness and non-acute treatment, find it more efficient to receive care by calling an ambulance due to their inability to see a primary care physician or receive treatment in a reasonable amount of time at a clinic.[2] These calls divert skilled emergency medical services (EMS) personnel and equipment and generally represent an inefficient use of these costly vital assets. These EMS systems are the first line of response for cities and communities across the country and provide a service fitting within the *National Response Framework*. They are meant not only to meet local demands of a given community on a day-to-day basis, but also to expand to meet the surge of larger and less frequent emergencies.

According to the California Ambulance Association, out of the 2.7 million ambulance transports annually in California, nearly 90 percent are for continuous medical care and no longer for emergency services.[3] Still, California pursues the conventional model and methodology of emergency response by sending highly trained responders to calls with the expectation that they are intervening in traumatic injuries and with the ultimate aim of transporting these patients to an emergency room where definitive care can be rendered.

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[1] Matt Zavadsky and Barbara Hooten, *Mobile Integrated Healthcare* (Burlington, MA: Jones & Bartlett Learning, 2016), 5–6.

[2] Joshua R. Vest and Larry D. Gamm, "Health Information Exchange: Persistent Challenges and New Strategies," *Journal of American Medical Association* 17, no. 3 (2010): 288–294, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2995716/.

[3] Daniel Smiley and Steven D. Smiley, *Ambulance Service Delivery and Efficiency in California, Emergency Medical Services Authority* (College Park, MD: Center for International Policy Exchanges, University of Maryland, School of Public Policy), accessed October 15, 2017, http://www.umdcipe.org/conferences/Moscow/papers/Ambulance_Service_Delivery_and_Efficiency_in_California.doc.

To have EMS and hospital emergency departments in California address the service demands and return to being a more available and reflexive system, adjustments in the way services are rendered are necessary. A few cities across the country have implemented pilot programs attempting to meet the medical demands of low-acuity calls using a combination of emergency medical response personnel and hospital employees and without the need to transport them to a hospital emergency room. The alternative care can be provided to patients who do not have emergency medical needs at the initial point of contact, but who do require assistance in their existing chronic health conditions. This alternative and more appropriate level of care, which has taken on the name of Mobile Integrated Health (MIH), has been modeled in a few communities in the country with a common goal of providing quality of care, making health care accessible, and decreasing the demand of emergency services for non-emergencies.

This research explores the potential of ambulance staffing variations to align with call demand, as well as how an MIH resource would impact the existing workload. This question also explores the effectiveness of other MIH programs in meeting patient needs concerning quality of care. The MIH system increases the options that an emergency responder can provide. Programs have been implemented in two ways. One method is designed to care proactively for patients who have been identified as high users of the emergency response system and to connect them to more precise programs or care to meet their needs other than a routine EMS response and transport to a hospital emergency department (ED). The second method of MIH implementation offers an alternative response than that utilized through the 9-1-1 system. The effort of answering this research question focuses on providing a process to measure existing EMS workload reductions through the addition of an MIH program.

This thesis focuses on a new model to deliver EMS in the city of Sacramento, California. The Sacramento EMS providers are piloting an innovative approach that has the anticipated result of decreasing the demand of emergency medical resources, increasing the quality of care, and lessening the current impact to hospital EDs by making health care more accessible to patients. This thesis attempts to quantify and measure the projected

effects that the MIH may have in making emergency medical response and care a more resilient system for the public it serves.

This research is intended to evaluate the impacts of applying a changed emergency medical response system to be delivered by the Sacramento Fire Department. The proposed MIH system, which this research evaluates, allows the cross staffing of ambulances with fire personnel and hospital employees who are behavioral health specialists, physician assistants, or nurses. With the cross-staffing model, the hospital employees are able to provide a health delivery strategy intended to serve a wide variety of patients' needs, including acute care, chronic care, and prevention services. This broader level of service can be rendered through the 9-1-1 system at a patient's home or wherever the patient is contacted. This research also conducts a comparative analysis of two different methods implemented by MIH programs and provide a process for evaluating impact to emergency resource availability for future use of other departments. This research also examines quality of care, making healthcare accessible, and decreasing the demand of emergency services for the existing system in Sacramento.

This research reviews four different MIH programs. The cities were selected because their program's date of implementation allows for data on their performance. The programs in the cities of Anaheim, California; Mesa, Arizona; Colorado Springs, Colorado; and Dallas, Texas have all been equally assessed by the stated goals of their program and implementation methods. The cities of Anaheim and Mesa have similar implementation methods through the utilization of calls received from 9-1-1, whereas the cities of Colorado Springs and Dallas both have chosen to focus on a specific population. This research uses both implementation methods to compare hypothetical scenarios of workload reduction if Sacramento were to employ either strategy.

The historical call data from past emergency medical responses offers a limited prediction of whether a patient will choose an alternative method of treatment offered by MIH. This study cannot predict the success if MIH is applied to the population; rather, it shows how often providing options would be appropriate. By utilizing case studies from the existing pilot programs, the researcher hypothesized another evaluation of how people may choose to be assisted. This research does not attempt to show outcomes of overall

health care improvement. Data illustrating long-term health care needs or patient improvement is limited, protected by health care providers, and difficult to obtain. Additionally, many changes are occurring in health care coverage. This thesis does not look at current legislation shaping the MIH system in the state of California, nor does it attempt a predictive analysis on impacts of MIH to sweeping national changes in healthcare insurance. The analysis of the hypothesized performance of MIH is based solely on existing historical data outlining emergency medical system demands on the Sacramento Fire Department.

In reviewing a few of the notable and well-established MIH programs for this study, the data reveals that each case study agency had some common goals it was trying to accomplish. For instance, all of the agencies were attempting to decrease the number of resources they had previously deployed to low-acuity calls, while increasing the level of service. Both Anaheim and Mesa programs are accomplishing decreased resource utilization by deploying their specialized response units with a dispatch system to direct them to the reported emergencies with low acuity. Both the Dallas and Colorado Springs programs have taken the approach of focusing their specialized response units to the highest utilizers of the 9-1-1 system by providing a more appropriate level of care for the system users. Based from the information that is currently available, it is unclear if any of the EMS systems have further capacity to increase the number of specialized response units to see a further reduction of 9-1-1 use and increase the level of care provided in lieu of being transported to a hospital ED. However, what is clear is that these case studies of mobile integrated health illustrate there are people in need of assistance in managing their own health care. All of programs have components of prevention, education, and assistance in navigating the health care system. Additionally, they have offered a better patient experience by checking vital signs, assisting in scheduling future medical appointments, or prescribing or filling prescriptions without needing to take the patients from their home. Each system has also been able to obtain a level of health information exchange, making PHI available to users in the field so the responders can make informed, and ultimately the best, decisions for the patients they are serving.

The findings of this thesis illustrate that the implementation of an MIH program in Sacramento could be effective in providing quality care, increasing the accessibility to health care, and decreasing demand of the existing emergency resources. For the department to move forward, stakeholders in health care in the Sacramento region must show support and conduct further analysis illustrating the benefits to each party. The hospitals, health plans, clinics, and emergency service providers will need to come to a consensus on a business model to support the endeavor. Stakeholders should identify work groups to focus attention on fiscal impacts and financial sustainability, program legal implications, technology, and program performance and governance. Also, stakeholders should consider a work group to address state policy that places limitations on alternative destination transports for medical care.

This research illustrates that large numbers of the population that has turned to EMS as their primary health care provider. This research illustrates the consequences that occur when an EMS system is used in this fashion and the resulting undesirable impacts. In lieu of public education campaigns to sway the public's use of the EMS system, the health care system has the demonstrated need to evolve with the creation of MIH programs. Bringing the option of low-acuity care directly to those who are requesting EMS in their living environment has proven to be a valid solution. All of the MIH programs reviewedd in this study did have educational components and capabilities of evaluating a person's living environment to increase a person's overall health. Existing programs also have capability to make sure other services, such as housing, primary care health, behavioral health, employment support, and benefits counseling are all made available to patients. These additional services have a success rate of improving the overall health of an individual and can accomplish the goal of MIH.

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I. INTRODUCTION

Due to the Affordable Care Act (ACA), millions of Americans now covered with health insurance have found it increasingly difficult to find primary care physicians.[1] Wait times for patient appointments stretch out months. Quite literally, the demand for health care has exceeded the capacity of the current system to supply it. Consequently, more and more people, particularly those seeking care for chronic illness and non-acute treatment, find it more efficient to receive care by calling an ambulance due to their inability to see a primary care physician or receive treatment in a reasonable amount of time at a clinic.[2] These calls divert skilled personnel and emergency medical services (EMS) equipment and generally represent an inefficient use of these costly vital assets. These EMS systems are the first line of response for cities and communities across the country and provide a service fitting within the *National Response Framework*. They are meant not to meet only local demands of any given community on a day-to-day basis but also to expand to meet the surge of any larger emergency that occurs less frequently.

According to the California Ambulance Association, out of the 2.7 million ambulance transports annually in California, nearly 90 percent are for continuous medical care and no longer for emergency services.[3] Still, California pursues the conventional model and methodology of emergency response by sending highly trained responders to calls with the expectation that they are intervening in traumatic injuries and with the ultimate aim of transporting these patients to an emergency room where definitive care can be rendered.

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[1] Matt Zavadsky and Barbara Hooten, *Mobile Integrated Healthcare* (Burlington, MA: Jones & Bartlett Learning, 2016), 5–6.

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[3] Daniel Smiley and Steven D. Smiley, *Ambulance Service Delivery and Efficiency in California, Emergency Medical Services Authority* (College Park, MD: Center for International Policy Exchanges, University of Maryland, School of Public Policy), accessed October 15, 2017, http://www.umdcipe.org/conferences/Moscow/papers/Ambulance_Service_Delivery_and_Efficiency_in_California.doc.

To have EMS and hospital emergency departments in California address the service demands and return to being a more available and reflexive system, adjustments in the way services are rendered are necessary. Pilot programs attempting to meet the medical demands have been implemented with a combination of emergency medical response personnel and hospital employees. With a hybrid of employees and skillsets, a broader level of care and more solutions can be offered to patients, most of which can be provided without the need of transporting them to a hospital emergency room. The alternative care can be provided to those patients who do not have emergency medical needs at the initial point of contact but who do require assistance in their existing chronic health conditions. This alternative and more appropriate level of care, which has taken on the name of Mobile Integrated Health (MIH), has been modeled in a few communities in the country with a common goal of providing quality of care, making healthcare accessible, and decreasing the demand of emergency services.

A. RESEARCH QUESTION

How will the Sacramento Fire Department be affected by the implementation of a mobile integrated health program? This research question explores the potential of ambulance staffing variations to align with call demand, as well as how a MIH resource will impact the existing workload. This question also explores other MIH programs' effectiveness of meeting patient needs concerning quality of care. The MIH system increases the options that an emergency responder can provide. Programs have been implemented in two ways. One method is designed to care proactively for patients who have been identified as high users of the emergency response system and to connect them to more precise programs or care in meeting their needs than a routine EMS response and transport to a hospital emergency department (ED). The second method of MIH implementation offers an alternative response than that which is utilized through the 9-1-1 system. The effort of answering this research question focuses on providing a process to measure existing EMS workload reductions through the addition of a MIH program.

Two challenges that all existing MIH programs must overcome during program design is data sharing among participating parties as well as establishing program

governance so that the cost savings discovered in more efficient and appropriate patient care can be shared by all agencies comprising the MIH system. Most data sharing of protected health information (PHI) occurs through contractual agreements called health information exchanges (HIEs). A health information exchange "allows clinicians access to data originating from other sites of care or service."[4] The exchanges follow regulation in PHI and assist in multiple care sites identify useful patient information, such as prescription lists, lab results, and medical history for efficiency and increased quality of care. With a MIH program, these exchanges of information are required to occur to the EMS worker, who is the end user in a field setting. Informed medical decisions being made for the patient in the field will often times eliminate a ride to the hospital ED for the same medical diagnosis or recommendation(s). The ACA has incentivized hospitals, commercial insurers, integrated delivery systems, and home health care to work together by creating and funding accountable care organizations (ACO) in which the patient care experience is tied to performance metrics.[5] This goal to reduce healthcare costs in the ACA is called value-based purchasing (VBP). Under VBP, the design of the patient experience can be affected by an entire group of health care services offered to a patient and the goal of many MIH systems is to attempt to become part of that funding system for program sustainability.

B. LITERATURE REVIEW

To evaluate the scope of the problems pertaining to EMS availability and how its limitations can affect the overall homeland security mission, this thesis includes a comprehensive review of existing literature. Since EMS availability and its ties to the homeland security mission may be separate issues having individual component parts, this literature is divided into three segments: homeland security initiatives for response, effects of overcrowding at hospitals, and the measured impacts to emergency medical responders.

[4] Mark E. Frisse et al., "The Financial Impact of Health Information Exchange on Emergency Department Care," *Journal of the American Medical Informatics Association* 19, no. 3 (2012): 328–333.

[5] Matt Zavadsky, "Mobile Integrated Healthcare: The Payer's Perspective," *Journal of Emergency Medical Services* (May 2014): http://www.jems.com/ems-insider/articles/2014/05/mobile-integrated-healthcare-the-payer-s-perspective.html.

1. Homeland Security and EMS

Although EMS is addressed in several places within the scope and responsibility of homeland security, most of the responsibility identified is for large-scale events and disasters. Within the *National Preparedness Guidelines* is a requirement for EMS to have the ability to care for a medical surge to a mass casualty event caused by a terrorist attack, a biological emergency, or natural disaster.[6] Literature is available addressing the lean EMS approach in delivering services to communities that do not have adequate training nor have the availability to increase resources to handle a disaster of any magnitude.[7] The U.S. Department of Homeland Security's *Target Capabilities List* guidelines specifically recommend that EMS have surge capacity to address tasks such as rapidly responding to a multicasualty incident (MCI) and providing an appropriate response to the sick or injured.[8] It is also easy to find documentation, such as the *2011 National EMS Assessment*, proving only 50 percent of EMS agencies with a transportation plan have the ability to take on a surge of patients if necessary.[9] This study also indicates that there is a discrepancy in any EMS system that coincides with the size of the population that it serves. In rural settings, the service is less likely to have any surge capacity and will likely be overwhelmed with an MCI surpassing its capacity with an incident of five or more patients.[10]

Although federal guidance describes how EMS systems are expected to perform in the event of an emergency, less than four percent of homeland security funds have been made available to EMS in the last 10 years.[11] Even if a local emergency were to occur and a need for a surge of resources to assist arose, the Stafford Act would have to be activated

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[6] Office for Domestic Preparedness, *National Preparedness Guidelines* (Washington, DC: U.S. Department of Homeland Security, 2007), 19–20.

[7] Malcolm Kemp, "Measuring Disaster Preparations of Local Emergency Medical Services Agencies" (master's thesis, Naval Postgraduate School, 2013), 64–75.

[8] U.S. Department of Homeland Security, *Target Capabilities List: A Companion to the National Preparedness Guidelines* (Washington, DC: U.S. Department of Homeland Security, 2007), 449–464.

[9] Greg Mears et al., *2011 National EMS Assessment* (Report No. DOT HS 811 723) (Washington, DC: National Highway Traffic Safety Administration, U.S. Department of Transportation, 2012), https://www.ems.gov/pdf/811723-National-EMS-Assessment-2011.pdf.

[10] Ibid.

[11] Lauren Simon Ostrow, "The Controversy over EMS, Homeland Security and the Feds," *Best Practices in Emergency Services* 8, no. 6 (2005): 61–63.

to allow for funding for the federal government to assist with additional resources. Due to the multiple steps and approval process, it is not well tailored to medical emergencies on a local level when they reach a catastrophic level.[12] The federal government does, however, identify emergency services as part of critical infrastructure, which includes fire, police, and EMS response systems.[13]

The term "resilience" has entered into the homeland security lexicon and is used broadly to describe physical infrastructure as well as key resources. Critical infrastructure resilience is defined in Presidential Policy Directive 21 as "the ability to prepare for and adapt to changing conditions and withstand and recover from disruptions. Resilience includes the ability to withstand and recover from deliberate attacks, accidents, or naturally occurring threats or incidents."[14] The *Quadrennial Homeland Security Review Report* also identifies resilience as one of three foundational elements essential to a comprehensive approach to homeland security.[15] The Homeland Security Advisory Council reviewed this concept further in the *Community Resilience Task Force Recommendations Report.*[16] In the findings and recommendations of this report, it states, "resilience planning enables communities to more effectively respond and recover from natural and manmade disasters—to absorb impacts and adapt to altered conditions." True resilience requires changes in culture; stakeholders at all levels must ask and answer the hard questions when it comes to a system relying on outside resources in the event of a large event.[17] The document further recommends that the quality of resilience should be addressed as

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[12] Sarah A. Lister, *The Public Health and Medical Response to Disasters: Federal Authority and Funding* (CRS Report No. RL33579) (Washington, DC: Congressional Research Service, 2006), 27.

[13] White House, Office of the Press Secretary, "Presidential Policy Directive-Critical Infrastructure Security and Resilience," February 12, 2013, https://obamawhitehouse.archives.gov/the-press-office/2013/02/12/presidential-policy-directive-critical-infrastructure-security-and-resil.

[14] Ibid.

[15] U.S. Department of Homeland Security, *Quadrennial Homeland Security Review Report: A Strategic Framework for a Secure Homeland* (Washington, DC: U.S. Department of Homeland Security, 2010), https://www.dhs.gov/xlibrary/assets/qhsr_report.pdf, ix.

[16] U.S. Department of Homeland Security, *Homeland Security Advisory Council Community Resilience Task Force Recommendations* (Washington, DC: U.S. Department of Homeland Security, 2011), https://www.dhs.gov/xlibrary/assets/hsac-community-resilience-task-force-recommendations-072011.pdf, 12.

[17] Ibid.

preparedness, although identifies the challenge of looking at a system and conduct planning based off of the premise of failure. Finally, the committee recommends that response should avoid being myopic and look beyond the day-to-day needs and prepare a system of resilience for a manmade or natural disaster.[18]

2. Overcrowding at Hospitals

A large component of any EMS system is the receiving hospital and its ability to provide care for the incoming patients. The hospitals should also have the ability to provide for surge capacity and have plans in place to staff and care for those in the event of a disaster or even a local event. Any limitations on patients getting into a hospital's emergency department are referred to as "access block."[19] An access block puts responding EMS on "diversion," wherein an ambulance with an incoming patient is directed to go to the next-closest emergency department.

Access block is also associated with physician and nurse-staffing level shortages to treat the high number of patients in the ED. A low hospital medical staff to patient ratio associated with access blocks can be linked to poor quality of care outcomes.[20] A 2009 study of 187 hospitals in the state of California illustrates that ED overcrowding is a direct link to increased mortality, longer hospitals stays, and increased healthcare costs.[21]

Beyond the diversions and difficulties of ambulances in choosing a hospital to transport to, it has now become increasingly difficult for the crews to transfer care due to the limited ED staff once inside the hospital. This situation keeps EMS crews in the hospital ED, which means they are not posted in the community available for the next reported emergency. A 2004 study of the Los Angeles Fire Department's EMS transport system captured the hospital wait times in an impacted system serving a large population. This

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[18] Ibid.

[19] Michael J. Bullard et al., "Tracking Emergency Department Overcrowding in a Tertiary Care Academic Institution," *Longwoods Review* 7, no. 2 (2009): 99–106.

[20] Robert Dunn, "Reduced Access Block Causes Shorter Emergency Department Waiting Times: An Historical Control Observational Study," *Emergency Medicine* (Fremantle) 15, no. 3 (2003): 232–238.

[21] Marc Eckstein et al., "Facilitating EMS Turnaround Intervals at Hospitals in the Face of Receiving Facility Overcrowding," *Journal of Pre-hospital Emergency Care* 9, no. 3 (July 2009): 267–275.

study indicated that ambulance crews would wait 27 minutes per patient as the median time, and in one out of every eight visits to the ED, the crew was waiting for over one hour.[22] In contrast to the reality in hospitals, this same study on EMS turnaround times in hospital EDs recommends that a transfer of patient care should only take a couple of minutes and rarely exceed 10 minutes.[23]

In an effort to mitigate this emerging problem of ED crowding and its effects on patient care, federal funds have been directed for assistance to states. From 2002 to 2007, the Office of the Assistant Secretary for Preparedness and Response directed funding in the sum of $2.2 billion to assist in meeting goals, including hospital surge capacity.[24] Some states reported they have been able to increase the number of ED bed space but staffing with physicians and nurses continued to be problematic.[25] The lack of staff for the EDs also affect the planning process when addressing disasters, and specifically, how patients would be cared for. Even though federal funds have been used to increase the availability of emergency care, the *New England Journal of Medicine* reported in 2006 that the number of U.S. hospital EDs have been reduced by nine percent as a result of limited funding, which equates to a reduction of 198,000 beds in the past decade.[26]

3. Limited Availability of Emergency Response Crews

A third contributing factor that has had a measurable impact on the EMS services is the increased number of calls for service. In particular is the type of calls the EMS responders are now being dispatched to when a person calls 9-1-1. The request for low-acuity medical treatment has depleted resources that should be available for true medical

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[22] Marc Eckstein and Linda S. Chan, "The Effect of Emergency Department Crowding on Paramedic Ambulance Availability," *Annals of Emergency Medicine* 43, no. 1 (2004): 100–105.

[23] Ibid.

[24] Cynthia A. Bascetta, *Emergency Preparedness: State Efforts to Plan for Medical Surge Could Benefit from Shared Guidance for Allocating Scarce Medical Resources* (GAO-10-381T) (Washington, DC: U.S. Government Accountability Office, 2010).

[25] Ibid.

[26] Arthur L. Kellerman, "Crisis in the Emergency Department," *New England Journal of Medicine* 355, no. 13 (2006): 1300–1303.

emergencies.[27] For instance between 1996 and 2006, there was a 36 percent increase for patients who were delivered to a hospital emergency department for a non-emergency medical need.[28] Options for deploying EMS resources to provide an alternative tier of care could increase their surge capacity and availability for true medical emergencies.

There are financial implications as a result of tying up hospital EDs and EMS services as well. A 2010 study revealed that between 13 percent and 27 percent of all hospital ED visits could have been handled at alternative sites and could have resulted in $4.4 billion in annual government healthcare savings.[29] Most of these frequent users of 9-1-1 systems could have their issues addressed by access to other services, such as primary care clinics, psychiatric or behavioral health specialists, or other social services.[30]

In addition, the rate at which patients visit the ED instead of attempting to see their primary care physician continues to increase with the rising enrollment for adult Medicaid.[31] One 2015 study indicated that half of adult patients transported to a hospital ED would have rather seen their primary care physician if they would have been immediately available.[32] This large number of patients contributes to the decrease in capacity of ED hospital bed space, as well as needlessly tying up EMS resources.

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[27] Edward Durant and Hana Fahimi, "Factors Associated with Ambulance Use among Patients with Low-Acuity Conditions," *Journal of Pre-hospital Care* 16, no. 3 (2012): 329–337.

[28] Institute of Medicine, *Emergency Medical Services: At the Crossroads* (Washington, DC: National Academic Press, 2007), 37.

[29] Robin M. Weinick, Rachel M. Burns, and Ateev Mehrotra, "Many Emergency Department Visits Could Be Retrieved Managed at Urgent Care Centers and Retail Clinics," *Health Affairs* 29, no. 9 (2010): 1630–1636, http://dx.doi.org/10.1377/ hlthaff.2009.0748.

[30] "Beyond 911: State and Community Strategies for Expanding the Primary Care Role of First Responders," National Association of Emergency Medical Technicians, December 2010, http://www.naemt.org/docs/default-source/community-paramedicine/mih-cp-grid/beyond-911_state-and-community-strategies-for-expanding-the-primary-care-role-of-first-responders.pdf?sfvrsn=4.

[31] Roberta Capp et al., "Do Adult Medicaid Enrollees Prefer Going to their Primary Care Provider's Clinic rather than Emergency Department (ED) for Low Acuity Conditions?" *Department of Health and Human Services* 53, no. 6 (2015): 530–533.

[32] Ibid.

4. What Is Not Known

To date, no known data identifies alternative EMS delivery models as a tool to enhance EMS capability as a homeland security resource or for the sake of national EMS resilience. Much of the data suggests that millions to billions of dollars have been invested in improving the surge capacity to the EMS model. Researchers have studied hospital ED availability and clearly quantify the significance to the lack of resources, such as bed space, surge capacity, and physicians and nurses to treat patients. Emergency plans designed to address how hospital surge capacity can affectively meet a community's population in the event of a disaster are inadequate.[33]

Studies completed in the state of California have explored the performance of alternative delivery models, such as the pilot paramedicine programs of 2015. The Community Paramedicine Pilot attempted to align itself with improving the patient experience, improving community health status, and decreasing the cost of care.[34] Although the pilot project created good data and showed merit in alternative methods of treatment, no link emerged to enhance the homeland security mission of resource availability and resilience.

There is no research connecting past national disasters, such as Hurricane Katrina, the terrorist attacks of September 11, 2001, or the response to biological events such as the Zika virus, or other emergencies to a model of increased resource availability given alternative methods of care. MIH data models, in which patient care is directed toward a more appropriate resource increasing the availability and resilience of EMS, are less than four years old and have been tested on limited populations. Without this data readily available, it is unknown if alternative models of care can support the homeland security initiative.

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[33] Bascetta, *Emergency Preparedness*.

[34] Janet M. Coffman et al., *Evaluation of California's Community Paramedicine Pilot Project* (San Francisco: Healthforce Center, University of California, San Francisco, 2017), http://www.emsa.ca.gov/Media/Default/PDF/Evaluation%20of%20California%C2%B9s%20CP%20Pilot%20Program_final.pdf.

C. RESEARCH DESIGN

This thesis focuses on a new model to deliver EMS in the city of Sacramento, California. The Sacramento EMS providers are piloting a innovative approach that has the possible outcome of decreasing the demand of emergency medical resources, increasing the quality of care, and lessening the current impact to hospital EDs by making healthcare more accessible to patients. This thesis attempts to quantify and measure the projected effects that the MIH may have in making emergency medical response and care a more resilient system for the public it serves.

This research is intended to evaluate the impacts of applying a changed emergency medical response system to be delivered by the Sacramento Fire Department. The proposed MIH system to be evaluated allows the cross staffing of ambulances with fire personnel and hospital employees who are behavioral health specialists, physician assistants, or nurses. With the cross-staffing model, the hospital employees are able to provide a health delivery strategy intended to serve a wide variety of patients' needs, including acute care, chronic care, and prevention services. This broader level of service can be rendered through the 9-1-1 system at a patient's home or wherever the patient is contacted. This research also conducts a comparative analysis of two different methods implemented by MIH programs and provide a process for evaluating impact to emergency resource availability for future use of other departments. This research also examines quality of care, making healthcare accessible, and decreasing the demand of emergency services for the existing system in Sacramento.

This research reviews four different MIH programs. The cities were selected because their programs date of implementation allows for data on their performance. The programs in the cities of Anaheim, California (CA), Mesa, Arizona (AZ), Colorado Springs, Colorado (CO), and Dallas, Texas (TX) have all been equally assessed by the stated goals of their program and implementation methods. The cities of Anaheim and Mesa have similar implementation methods through the utilization of calls received from 9-1-1, whereas the cities of Colorado Springs and Dallas both have chosen to focus on a specific population. Both implementation methods are used to compare hypothetical scenarios of workload reduction if Sacramento were to employ either strategy.

The historical call data from past emergency medical responses offers a limited prediction of whether a patient will choose an alternative method of treatment offered by MIH. This study cannot predict the success if MIH is applied to the population; rather, it shows how often providing options would be appropriate. By utilizing case studies from the existing pilot programs, another evaluation of how people may choose to be assisted can by hypothesized. It does not attempt to show outcomes of overall healthcare improvement. Data that illustrates long-term health care needs or patient improvement is limited, protected by health care providers and difficult to obtain. Additionally, many changes are occurring in healthcare coverage. This thesis does not look at current legislation shaping the MIH system in the state of California and does not attempt a predictive analysis on impacts of MIH to sweeping national changes in healthcare insurance. The analysis of the hypothesized performance of MIH is based solely on existing historical data that outlines emergency medical system demands on the Sacramento Fire Department.

The source of data for this study are primarily from software used by the Sacramento Fire Department that records emergency medical services activity. This thesis uses the following data sets:

- Computer aided dispatch records, which provide emergency medical incident data and initial patient information provided by the person reporting the emergency.
- Fire department records management system (FDM software), which provides descriptions of care given and incident type. Incident types are often times adjusted from the initial call type reported in computer aided dispatch.
- Emergency medical services billing records (Intermedix Corp.), which provides greater detail of the level of care provided when a patient is transported to an emergency room.

After assimilating the types of calls for service in the Sacramento Fire Department's EMS records system, this analysis compares other cities MIH programs response model. The predictive model illustrates the effects (desired or undesired) and assists in determining outcomes. Taking the general principles of MIH and predicting the programs impact uses the deductive method of analysis. This study's outcome shows how often MIH would be

used if implemented from call type and frequency, then illustrates hypothetically the impact of reducing the existing workload. This analysis will assist the Sacramento Fire Department specifically in measuring the reduction of the existing workload while increasing ambulance availability. The measurement of predicted use of MIH also illustrates the amount of use a more accessible form of healthcare would be used while providing quality care with those services.

1. Methodology and Evaluative Criteria

To conduct a thorough evaluation of the implementation of a MIH program in the city of Sacramento, this thesis first examines elements from existing programs. Direct reference of only specific measures of each program will be considered for the comparative analysis. This is limited to only comparing programs that have similar deployment models, and level of care and treatment that is provided. By limiting the analysis to complete a set of predictive analytics that would be most accurate, several other portions of the program, such as the socioeconomics, population size, and patient demographics are not considered in this research. Additionally, some of the concepts and techniques that have been implemented by mobile integrated health programs have been successful and have tremendous value. Some programs have found methods for health information exchange among a broad network of healthcare providers and aligned their program within a system for funding and sustainability. By including an examination of the variety of techniques, their implementation challenges and the value they have added is listed in effort to make this research as comprehensive as possible.

2. Data Collection

To complete a comprehensive assessment of programs that currently exist or have been attempted, research includes mobile integrated health, community paramedicine, fire based EMS, public health, and EMS and homeland security. Each finding had varying elements of information that contributed to answering the research question. If any measurement model was utilized to address quantifying the success or failure of each program, they have been included in this research.

The data analyzed for the Sacramento Fire Department has been obtained through many existing databases and programs. A summary of Sacramento Fire Department dispatch data already exists and is given to the department on an annual basis to reflect all call history and department activity for a calendar year. Additionally, data used by the department's records management system has been summarized because it is a better indicator of patient outcome. The reports in the records management system are input from the fire personnel that provide patient care so the data is often times be adjusted from the fire dispatch data, which is limited information provided during the initial 9-1-1 call. These data elements are organized into reports and do not include any patient or protected health information. This database captures more detailed information about the action the fire department took or the status of a patient once assessed by emergency personnel in contact with the patient.

3. Data Analysis

This research utilized data obtained through the process described above to compare like data elements from each existing program. Because the elements of each program were, in some cases, not described where a comparison could be drawn, it is stated. The analysis discusses some comparisons of program concept, purpose, and policy. This researcher only conducted a comparative analysis when the comparative agency dispatch types and call outcomes match those of the Sacramento Fire Department. This thesis uses comparative analysis as a predictive measure of a mobile integrated health with similar program concepts described, and how it would perform if implemented by the Sacramento Fire Department.

This thesis reviews a description of the existing EMS system in Sacramento to give context to the implementation of a MIH model. This includes dispatching processes, frequency and types of calls the system is currently handling, as well as an overview of the efficiency of resources. The next section examines the application of MIH in four cities. The state of the EMS system prior to implementation, the reasons for implementation, call volume, policy issues, program goals, along with the programs successes and failures will be reviewed. The cities chosen for this thesis have two different implementation methods.

For instance, the cities of Anaheim and Mesa have implemented programs by adding MIH as part of their 9-1-1 response system, whereas the cities of Dallas and Colorado Springs have chosen to focus their MIH resources on a target population. This thesis reviews the differences of each implementation method and creates the possibility of a comparative analysis for each type of program method implementation for the Sacramento Fire Department. It is the purpose and intent of this research to provide a methodology of evaluation that can be used for future evaluations of the effectiveness of the MIH model when examining EMS resources.

Some programs of MIH implementation had a wealth of data and literature for review while others were very limited. This research used the most comprehensive means to obtain program information to establish a valid argument and complete the deepest understanding of each model. This research will also highlight the varying program goals and implementation methods of this thesis to illustrate the key elements of existing programs and to assist in future research and study.

The performance and data found on the cities selected for this research is used to predict outcomes when applied to the current EMS system in Sacramento. This research uses both MIH implementation models to create a predicted analysis of call volume reduction and increased ambulance availability, which is measured by workload. In the final chapter, the recommendations of program implementation addresses issues of policy, technology and information exchange, and funding required to complete a full, self-sustaining MIH model

II. MOBILE INTEGRATED HEALTH CONTEXT IN SACRAMENTO

In effort to modify the existing EMS model to illustrate the effectiveness of MIH, This chapter presents an overview of the laws that govern the system and other external influences of an EMS system. The EMS laws in the state of California, like most states, continue to evolve so the structure of the system has relevance in the larger scope of the nation's health care system. This chapter provides insight of the emergence of EMS in the state and an overview of the current response model in the city of Sacramento while illustrating some current challenges with system performance.

A. SACRAMENTO DEMOGRAPHIC INFORMATION AND HEALTH CARE SYSTEMS

In the state of California, the EMS authority resides both at the state and county levels. Prior to 1980, there was a lack of coordination among hospitals, physicians, emergency medical providers, and health care administrators. To increase this coordination and manage emergency and disaster services, Governor Jerry Brown signed the Emergency Medical Services System and Prehospital Emergency Care Personnel Act (SB 125), creating the California Emergency Services Authority (EMSA).[35]

The EMSA provides oversight and coordination for 33 smaller geographic areas within the state called Local Emergency Medical Service Authorities (LEMSA). These 33 areas encompass the state's 58 counties. Some of the EMSA responsibilities include statewide standards for EMS systems and guidelines for the assessment of critical care programs in pre-hospital care. Moreover, the EMSA is the approval authority for each LEMSA plan, which is required to provide a minimum standard of response capability and guidelines of care.

In Sacramento County, the four largest fire agencies—the Sacramento Fire Department, Sacramento Metropolitan Fire Protection District, Cosumnes Fire Protection

[35] California Emergency Medical Services Authority, "History and Background," accessed Ocotber 15, 2016, http://www.emsa.ca.gov/About_EMSA.

Services District, and City of Folsom Fire Department—provide ambulance services with limited surge capacity, which is contracted through a private ambulance company. Together, these agencies provide in upwards of 50 advanced life-support ambulances that transport patients through the 9-1-1 system to the regions hospitals. Outlined within the agreement of the Sacramento LEMSA, the fire agencies hold the rights to all dispatches to 9-1-1 requesting emergency medical response. Although there are private ambulances within Sacramento County, they are solely providing interfacility transports. All fire agencies in Sacramento County are in a contracted joint powers authority (JPA) to manage and fund a single fire dispatch center called the Sacramento Fire/EMS Emergency Communications Center (SRFECC).

The Sacramento Fire Department provides service to the city of Sacramento and two contract areas serving just under half a million people covering 146.3 square miles. The department's EMS assets include 24 fire engines, eight trucks, and one technical rescue company that provide a minimum of basic life support to their response areas. The department also operates 15 full-time, advanced life-support ambulances, which are each staffed with at least one paramedic firefighter and one emergency medical technician firefighter. The department also staffs up to three additional peak hour ambulances that are assigned to events or cover gaps in the system.

Researchers have determined that a person's location and environment are large contributors to one's overall health. The Center for Disease Control has identified a formula named the social detriments of health. This formula quantifies where people live, their access to education, their employment opportunities, their housing, and other conditions and scores the results. The 2015 data shows that residents in Sacramento County have an unemployment rate of 8.8 percent whereas the U.S. median is 7.1 percent.[36] Additionally, the poverty rate and housing costs indicate that Sacramento has been behind compared to the national median. As of 2015, what does bode well for Sacramento County

[36] U.S. Department of Health and Human Services, Center for Disease Control and Prevention, "CHSI Information for Improving Community Health, Sacramento County," accessed April 29, 2017, https://wwwn.cdc.gov/CommunityHealth/profile/currentprofile/CA/Sacramento/.

is that 98.5 percent of people have access to a primary care provider.[37] This statistic means that because individuals were afforded a level of health insurance, they were able to develop healthy and sustained relationships with a health care network.

One of the most pressing problems facing Sacramento is its growing homeless population. A 2017 report on homelessness in Sacramento County indicates there are approximately 5,600 people experiencing homelessness in Sacramento County during the year, and over 2,600, or 35 percent, on any given night are without shelter.[38] These people are not only in need of housing, and there are many factors in their lifestyle that are detrimental to their overall health. While there is limited data on this specific population, the report indicates that 27 percent are mentally ill, 48 percent suffer from addiction to alcohol or drugs, and 16.7 percent are chronically homeless.[39] Many of the individuals who fall into the category of homelessness receive emergency medical care instead of preventative care to manage their health needs. In support of this, Sacramento Fire Department emergency medical records indicate that 10 percent of the department's patient contacts, equating to 8,800 contacts a year, are with homeless persons.[40] The issue compounds itself when the patient is treated for an immediate medical need and then discharged from a medical facility only to return to the streets, unhealthy habits, and a lack of regular medical care.

The Office of Statewide Planning and Development produces data that tracks the number of people who enter emergency care in EDs by county in the state of California. The 2016 report indicates that 562,870 people visited an ED in Sacramento County, of whom 95.52 percent were discharged without further care necessary.[41] This high

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[37] Ibid.

[38] California State University Sacramento, *Homelessness in Sacramento County: Results from the 2017 Point-in-Time Count* (Sacramento, CA: Sacramento Steps Forward, 2017), http://www.saccounty.net/Homelessness/Documents/2017_SacPIT_Final.pdf.

[39] Ibid.

[40] Information provide to author by Sacramento Fire Department Records Management System, August 22, 2017.

[41] Office of Statewide Health Planning and Development, *Frequency of Encounters by Patient County of residence and Disposition Emergency Department Data 2016, Patient County Sacramento* (Sacramento, CA: Office of Statewide Health Planning and Development, 2017), https://www.oshpd.ca.gov/documents/HID/EDASData/2016-FrequenciesbyPatientCounty-ED.pdf.

percentage may be indicative of the frequency that people utilize emergency care but not for high acuity medical needs.

B. SACRAMENTO EMERGENCY MEDICAL RESOURCE DEPLOYMENT

SRFECC is a secondary 9-1-1 public safety answering point operating under the authority of a JPA. The Sacramento region transports patients to nine area hospitals within the county and three additional hospitals within the region. When a citizen in Sacramento County calls 9-1-1 and reports a medical emergency, the dispatchers are trained to provide enhanced 9-1-1 telephony,[42] which includes emergency medical dispatching (EMD) lifesaving instructions. In 2016, the Sacramento Fire Department responded to 88,241 incidents. Each incident is broken down into 1,599 incident types that fall into three main categories: medical, fire and special operations. Out of the 88,241 calls in 2016, 74,907 (84.89 percent) were categorized as medical in nature.[43]

All of the reported medical emergencies through 9-1-1 enter into the response system through the process of fire dispatch. The SRFECC utilizes a rapid dispatch system to determine the caller's location, callback information, and type of emergency as well as deploys the closest ambulance and first responder. While the emergency responders are en route, the dispatcher begins to ask scripted questions to further classify the emergency and provide direction to assist the patient until resources arrive on-scene. Using the *International Academy QA Guide*, version 13, the emergency information is categorized into one of 33 call types.[44] The dispatcher asks additional screening questions, and the level of acuity is assigned based on still further questioning of the caller. Levels of acuity are categorized by lowest to highest using letters A, B, C, D, and E. There is also an acuity determinant, *omega*, which ultimately is used to categorize calls for which no medical care is necessary.

[42] Enhanced 9-1-1 telephony is a system that links emergency callers to the correct emergency services while attempting to automatically identify the caller's location.

[43] Sacramento Regional Fire/EMS Communications Center, "Annual Report Synopsis" (internal document, Sacramento Regional Fire/EMS Communications Center, 2016).

[44] *The International Academy QA Guide*, Vol. 13 (Salt Lake City, UT: Priority Dispatch Corporation).

Another document that outlines workload for the Sacramento Fire Department is a 2015 standards of cover study, which considers the adequacy of the resource deployment, the associated risks present in Sacramento, and incorporates the level of desired outcomes by the community. A portion of the study examines ambulance performance metrics based on the prior three years of historical data by fiscal year. This report calculates the resource utilization by looking at the total number of hours a resource is in service and then illustrating how often that resource is assigned to an emergency incident and not available to respond. This calculation is expressed by unit hour utilization (UHU) and appears in the study as the ambulance availability per hour of the day. This measure of efficiency use of resources is common for both public and private emergency response resources. The calculation of UHU is coupled with performance goals, so any given system can look at historical data to illustrate system demand. This data gives indicators of the number of ambulance resources that should be in service by time of day and day of the week. The goal of performance is usually stated in response times by a fractal assessment (e.g., 11 minutes or less, 90 percent of the time).[45] By monitoring the historical performance of a system's resources in this fashion, data-driven decisions can be made based on the quantity of work as well as the level of responsiveness.

However, this measure of work does not give indications of quality of care. At the time of this study, the department was staffing 13 ambulances instead of the current 15. The report indicated in finding 17 that 10 of the city's ambulances exceeded the 30 percent unit–hour utilization rate for most daylight hours, seven days a week.[46] Additionally, finding 18 of the study states, "the workload on the ten busiest ambulances is past the critical saturation point and crew effectiveness, training, and availability for incidents suffers."[47] The report went further to state that the addition of peak-hour ambulances should occur as soon as possible.

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[45] Smiley and Smiley, *Ambulance Service Delivery*.

[46] Citygate Associates, *Fire Department Standards of Response Cover Review* (Folsom, CA: Citygate Associates, 2016), 62.

[47] Ibid.

The standards of cover study did not provide any recommended changes to tailoring the level of service to change outcomes. The recommended performance measure for the existing EMS system is to "deploy using full and part-time units to deliver transport services where needed to patients, within 8 minutes travel time, or 11:00 minutes/seconds total response time from fire dispatch receiving the call for assistance."[48] Making adjustments to the number of resources from historical data will only result in adjustments of workload. The standards of cover study did not evaluate any qualitative measures of service by the Sacramento EMS system by taking a closer look into quality of care and patient outcome.

[48] Ibid., 5.

III. ANALYSIS OF MOBILE INTEGRATED HEALTH MODELS

This chapter reviews the different efforts that have been implemented by fire based mobile integrated health models. Because most programs are relatively new, the data may be limited based on illustrating only a few years of program success. This review attempts to capture the agencies reasons for changing their EMS model, a policy review and attempt to gain insight on the programs measured success.

A. ANAHEIM FIRE AND RESCUE COMMUNITY CARE RESPONSE UNIT

In 2016 the Anaheim Fire and Rescue Department tested a new EMS delivery model as a result of an increasing call volume with a large percentage of those calls being low acuity. The implementation method it used was through its existing 9-1-1 services and they added a specialized unit that would respond to those calls fitting a category of call type where service would most likely be rendered on site in lieu of services through a hospital ED. The response unit is staffed 40 hours a week with a firefighter paramedic and a nurse practitioner. The resulting impact is a 40 percent reduction of hospital transports to those they come in contact with.

The Anaheim Fire and Rescue Department serves a community of more than 351,000 residents.[49] In the development of the department's 2015–2020 strategic plan, it identified EMS delivery as an area in need of change. This prediction was based on the Affordable Health Care Act (AHC) and the way the community began using EMS services as a result of it.[50] In 2014, the department responded to 30,578 emergency calls, 85 percent of which were medical in nature, an increase of 14 percent.[51] Out of the EMS calls, 36 percent (9,339) were categorized as non-urgent, or low acuity in nature.

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[49] U.S. Census Bureau, "Quick Facts, City of Anaheim, California Population Estimates," July 1, 2016, https://www.census.gov/quickfacts/fact/table/anaheimcitycalifornia#viewtop.

[50] Anaheim Fire and Rescue, *Anaheim Fire and Rescue Strategic Plan 2015–2020* (Anaheim, CA: Anaheim Fire and Rescue, 2015), https://www.anaheim.net/DocumentCenter/View/9501.

[51] Anaheim Fire and Rescue, *Anaheim Fire and Rescue Community Care Response Unit* (Anaheim, CA: Anaheim Fire and Rescue, 2014), http://www.anaheim.net/DocumentCenter/View/7997.

The department partnered with Kaiser Permanente of Orange County, CARE Ambulance Services, and Metro Cities Fire Authority to put a community care response unit in service. A dispatch center screens the 911 calls and deploys the unit on the low acuity calls such as headaches, back pain, falls, or respiratory infections. The nurse practitioner can provide a broader scope of service such as sutures for wounds or prescribe medications for a patient. Providing patient care in the field and eliminating an expensive transportation to the emergency room is an added efficiency to the response system. This new resource is called the Community Care Response Unit (CCRU), and it is deployed in geographic area of the city receiving the highest number of low acuity calls only during identified peak call volume periods.

B. MESA FIRE AND MEDICAL DEPARTMENT COMMUNITY CARE RESPONSE

In 2008 the Mesa Fire and Medical Department tested a new EMS delivery model as a result of an increasing call volume with a large percentage of those calls being low acuity. The implementation method it used was through its existing 9-1-1 services, and it added two specialized units that would respond to low acuity calls fitting a category of call type where service would most likely be rendered on site in lieu of services through a hospital ER. The initial program consisted of a behavioral health response unit (BHRU) and a CCRU. The resulting impact was a 40 percent reduction of hospital transports to those the CCRU would make contact with and a 10 percent success rate with the BHRU.

The Mesa Fire and Medical department serves a population of 484,587 residents.[52] In 2008, the leadership in the city requested the department identify a more cost-efficient way to operate during the Great Recession era and continue to meet the needs of the city. As a result, Mesa Fire and Medical became one of the first models of a changed EMS delivery system. The department had the dispatch center begin to triage 911 emergencies and would send a two-person "transitional response vehicle" instead of a four-person fire

[52] U.S. Census Bureau, "Quick Facts, City of Mesa, Arizona Population Estimates on July 1, 2016," accessed September 2, 2017: https://www.census.gov/quickfacts/fact/table/mesacityarizona/PST045216.

unit.[53] In the Mesa response area, nearly 43 percent of the ambulance transports were low-acuity calls.[54] In 2013, Mesa Fire and Medical again modified this response and began deploying two TRVs, which were cross staffed with one fire captain paramedic and a nurse practitioner or a behavioral health specialist. These units demonstrated they could successfully address 10 percent of 911 calls dealing with substance abuse or mental illness, and the other unit showed a 40 percent success rate in addressing low acuity calls while operating 40 hours per week.[55] Additionally, the behavioral health units were able to focus on treating and referring patients to a primary care physician or other appropriate healthcare providers.

In 2014, the city of Mesa implemented a Community Care Initiative, which is a public-private partnership polling firefighter paramedics with nurse practitioners, behavioral health specialists, and physician assistants. In September of 2014, the city of Mesa won a $12.5 million grant from Centers for Medicare and Medicaid Innovation Grant with a performance period of three years. These funds assisted in increasing the staffing of the newly named community care units to 24 hours a day, seven days a week. The program has also funded registered nurses to work in the dispatch center to help by offering a higher level of licensed medical advice by phone, which could negate the need of deploying any units.[56]

C. DALLAS FIRE AND RESCUE DEPARTMENT

In the early 2000s, Dallas Fire and Rescue noted trends in its EMS system in an increase of call volume of low-acuity medical aids. The department leadership designed a program to increase the knowledge and skillset of some of the paramedic firefighters to focus on primary care for the chronically ill, follow up procedures for post-operation

53 "Fired Up: Community Paramedicine Models Blaze a Trail for Healthcare Reform," *Arizona Health Futures* (February 2016), http://vitalysthealth.org/wp-content/uploads/2016/02/Community-Paramedicine-February-2016.pdf.

54 "City of Mesa Community Care Initiative," International City/County Management Association September 1, 2016, https://icma.org/documents/city-mesa-community-care-initiative.

55 Ibid.

56 Ibid.

patients, and connecting patients with community resources to aid in their healthcare.[57] Unlike prior models reviewed above, this program focuses on a population of people who would likely utilize 9-1-1 as a means of healthcare with the goal to prevent them from needing to request those services.

The program consisted of partnering with Dallas hospitals and healthcare agencies to provide scheduled care to the programs identified high-risk patient populations. One of the stated goals of the program was to increase the availability of the existing 40 frontline and three peak demand ambulance units provided by the department by reducing the dependence of the 9-1-1 system.[58] In 2014, the department evolved the program and changed the name to the Mobile Community Healthcare Program with an aim at identifying the 9-1-1 systems most frequent users and begin scheduling individualized preventative care.[59] This enhancement of the system was supported by the Dallas City Council, which allocated $600,000 in fiscal year 2013–2014 for five firefighter paramedics to staff the positions.[60] The program successfully enrolled 73 of the 9-1-1 system's top users and achieved a reduction of 9-1-1 use from this group in 2015 by 83.5 percent.[61] The program not only reduced call volume for the ambulance system, it achieved its goal of increasing the level of independence and wellbeing of the citizens it served.

D. COLORADO SPRINGS FIRE DEPARTMENT

In 2012, the Colorado Springs Fire Department acted on the trend of rising medical aids. The department responds to over 60,000 calls annually and identified its emergency medical personnel over responding and not serving in the capacity in which they were

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57 Public Safety Committee, "The Future of Dallas Fire-Rescue Emergency Medical Service," November 18, 2013, presentation slides, https://www.naemt.org/Files/MobileIntegratedHC/Dallas%2520Fire%2520Rescue%2520MIH%2520Presentation.pptx+&cd=4&hl=en&ct=clnk&gl=us.

58 Ibid.

59 Ibid.

60 "Quick Look: Dallas Fire-Rescue launches mobile Integrated Health Care Program," National EMS Management Association, last updated February 2015, https://www.ems1.com/community-paramedicine/articles/1977837-Quick-Look-Dallas-Fire-Rescue-launches-mobile-integrated-health-care-program/.

61 Public Safety Committee, "Mobile Community Healthcare Program," April 27, 2015, presentation slides, https://dallascityhall.com/government/Council%20Meeting%20Documents/2015/PS_6_Mobile-Community-Healthcare-Program_Combined_042715.pdf.

trained.[62] The department found that 81percent of its total calls were EMS in nature and 18.1 percent of them involved behavioral health issues. Out of the behavioral health related calls, 98 percent of the patients were transported to a hospital ED.[63] By implementing a focused program to bring resources to those with behavioral health issues prior to them calling 9-1-1, the result has been a 50-percent reduction of 9-1-1 reported emergencies from that group.

In 2012 the department partnered with the University of Colorado Health Memorial Hospital and Centura Health System's and began deploying a physician partnered with a firefighter paramedic to assess the homes and living conditions of the 9-1-1 systems most frequent users. In approximately three months, the deployment model proved not all patients needed the medical expertise of a physician; rather, the responders were confronted with educational needs of chronic illness and psychosocial issues. After about a year of implementation, the program changed its model and replaced the physician with a behavioral health specialist or nurse practitioner. The team made over 200 contacts in the first year and reported that 77 percent of the patients had mental health issues accompanied by other chronic health conditions.[64] The team members reported that they saw nearly 500 patients in the year 2014 and because of the preventative education and care, they saw a reduction in the groups use of 9-1-1 decreased by 50 percent.

The Colorado Springs program continued its expansion, adding a response unit that included a firefighter paramedic, behavioral health clinician, and law enforcement officer to respond to 9-1-1 calls that are psychiatric in nature. The team composition was a result of a continuous goal of meeting the needs and creating an appropriate path for the psychiatric patients. Unlike many of the other programs, funding for the Colorado Springs

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62 National Association of Emergency Medical Technicians, "Colorado Springs Fire Department: Partnering with Hospitals, Medicaid Care Coordination Organization to Reduce 911 Calls," in Mobile Integrated Healthcare and Community Paramedicine (MIH-CP), 26–27 (Clinton, MS: National Association of Emergency Medical Technicians, 2015), https://www.naemt.org/docs/default-source/MIH-CP/naemt-mih-cp-report.pdf.

63 Stein Bronsky, Kristin Giordano, Robin Johnson, "Mobile Integrated Healthcare Program Changing How EMS Responds to Behavioral Health Crises, *Journal of Emergency Medical Services* 41, no. 10 (2016), http://www.jems.com/articles/print/volume-41/issue-10/features/mobile-integrated-healthcare-program-changing-how-ems-responds-to-behavioral-health-crises.html.

64 Ibid.

is accomplished through private-public partnerships, hospitals, and the fire department for a continuous sustainment. Furthermore, the program has grown into two critical response teams that each work a 40-hour week with one overlapping day, identified by the data indicating the highest volume.

E. MOBILE INTEGRATED HEALTH PROGRAMS OVERVIEW

In reviewing a few of the notable and well-established mobile integrated health programs for this study, reveals that each agency had some common goals it was trying to accomplish. For instance, the agencies were all attempting to decrease the number of resources they had previously deployed to low acuity calls, while increasing the level of service. Both Anaheim and Mesa are accomplishing decreased resource utilization by deploying their specialized response units with a dispatch system to direct them to the reported emergencies with low acuity. Both the Dallas and Colorado Springs models have taken the approach of focusing their specialized response units to the highest utilizers of the 9-1-1 system by providing a more appropriate level of care for the system users. Based from the information that is currently available, it is unclear if any of the EMS systems have further capacity to increase the number of specialized response units to see a further reduction of 9-1-1 use and increase the level of care provided in lieu of being transported to a hospital ED. What is clear, however, is these case studies of mobile integrated health illustrate there is a population in need of assistance in managing their own healthcare. All of programs had components of prevention, education, and assistance in navigating the healthcare system. Additionally, they have offered a better patient experience by checking vital signs, assisting in scheduling future medical appointments, or prescribing or filling prescriptions without needing to take the patients from their home. Each system has also been able to obtain a level of health information exchange, making PHI available to users in the field so the responders can make informed, and ultimately, the best decisions for the patients they are serving.

The effort to identify the impacts of a MIH program and provide quality of care, increasing the accessibility of healthcare, and decreasing the demand of emergency service resources can assist in the overall homeland security mission. The close evaluation of

existing MIH programs, their policy, goals, and performance, as compared to the existing measures of workload and availability of EMS resources, has provided a tool that can assist in measuring overall system resource availability. The next section take an additional look at and discusses the existing opportunities as well as some of the largest obstacles, such as creating a health information exchange and establishing governance and sustainability for such a program.

F. OUTCOMES OF PREDICTED CALL VOLUME CHANGE

All four fire-based MIH programs examined had a goal of reducing the utilization of their existing medical resources. Each agency identified that the level of care it was initially providing was not sufficient for the needs of a large portion of the patients that utilized emergency medical services. The utilization of the agencies' ambulances was incredibly high, and the type of care provided was not sustainable. The agencies moved into a MIH model to increase their quality of care, make healthcare more accessible, and attempt to decrease the demand of their existing EMS resources. Although the agencies had similarities in their efforts, there was some variation to their deployment. Table 1 illustrates each of the programs goals and methods of implementation.

Table 1. Evaluation of Program Goals and Implementation Methods

Fire Department	Program Goals	Implementation Method
Anaheim Fire and Rescue	• Provide resource for low acuity calls • Increase availability of existing ambulance fleet • Study the effectiveness of definitive care delivery on-scene in place of an unnecessary transport to the hospital • Improve efficiency and effectiveness of fire/EMS service delivery for the community in a sustainable partnership	• Through existing dispatch, deploy one unit staffed with a nurse-practitioner and firefighter paramedic • Public / private partnership • Staff unit 40 hours per week and respond to appropriate call types based on proximity and availability
Mesa Fire and Medical Dept.	• Provide resource for low acuity calls • Reduce number of non-critical admissions to hospital EDs • Reduce hospital readmissions post-discharge	• Through dispatch, deploy one unit staffed with a nurse-practitioner or behavioral health specialist and firefighter paramedic

Fire Department	Program Goals	Implementation Method
	• Provide field treatment to low acuity patients • Reduce the use of the 911 system	• Public / private partnership • Staff unit 24/7
Dallas Fire-Rescue Dept.	• Empower patients to better manage own health/support needs • Bridge gap between social service agencies, mental health agencies, hospital programs and patient • Reduce transports of low acuity patients to hospital ED	• Identify and enroll the top 73 utilizers of 911 for medical care • Schedule visits with users and enroll them in a program • Provide 6 full time firefighter paramedics to staff program • Partner with hospitals for continuity of the program goals
Colorado Springs Fire Dept.	• Reduce the use of the 911 system • Reduce recidivism of patients with behavioral health issues • Provide resource for low acuity and psychiatric/behavioral health calls	• Identify and enroll 76% of the frequent users of 911 • Deploy with a team consisting of behavioral health clinician, law officer, and fire paramedic • Partner with health org's and police/fire dept. funding • Initial support from state grant • Two teams that work 40 hours a week overlapping to provide service 7 days-a-week

Both the Mesa and Anaheim Fire Departments have taken a common implementation approach by providing specialty resources that respond within the 9-1-1 system. They are staffed during identified peak periods and are meeting some of the stated program goals. Additionally, the Mesa Fire Department and Anaheim Fire Department have achieved a success rate of 40 percent of those patients their MIH unit comes into contact with; they sufficiently provide care and do not need to take a low acuity patient to a hospital ED. By keeping this resource as a 9-1-1 response vehicle to specific call types, this approach is reactive in that the care is not provided until the patients report that they feel they have an emergency.

The Dallas Fire and Rescue Department and the Colorado Springs Fire Department have taken a different approach to implementation by identifying the 9-1-1 systems top utilizers and providing proactive services. Both agencies rely on achieving their goals by

providing quality care, increasing the accessibility of healthcare, and decreasing the demand of their existing emergency medical resources to the identified group that already used it the most. See Figures 1, 2, and 3 illustrating current EMS models as compared to MIH models.

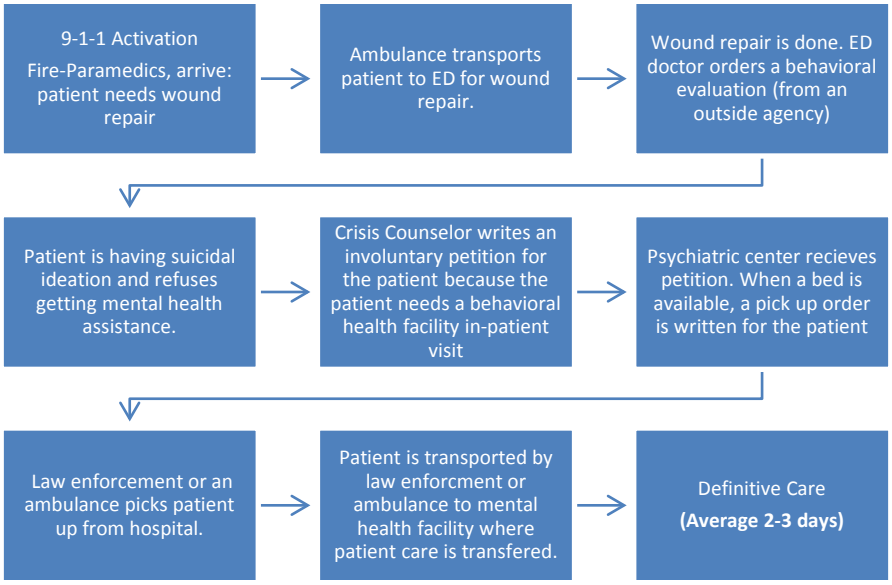

Figure 1. Illustration of Current EMS Model of Response for Behavioral Health

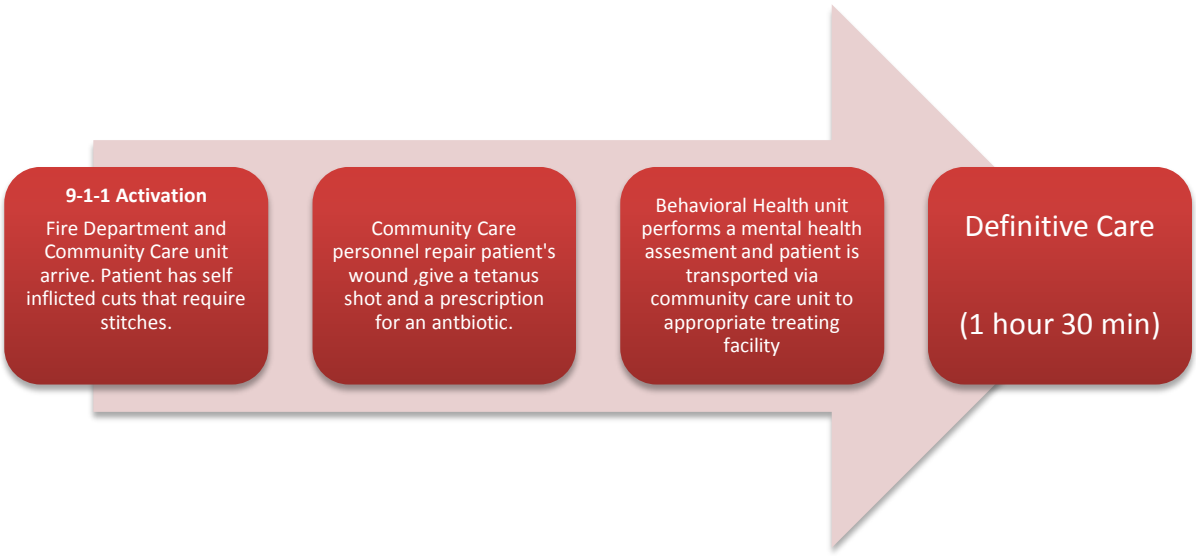

Figure 2. Illustration of MIH Model of Response by Anaheim and Mesa Fire Departments

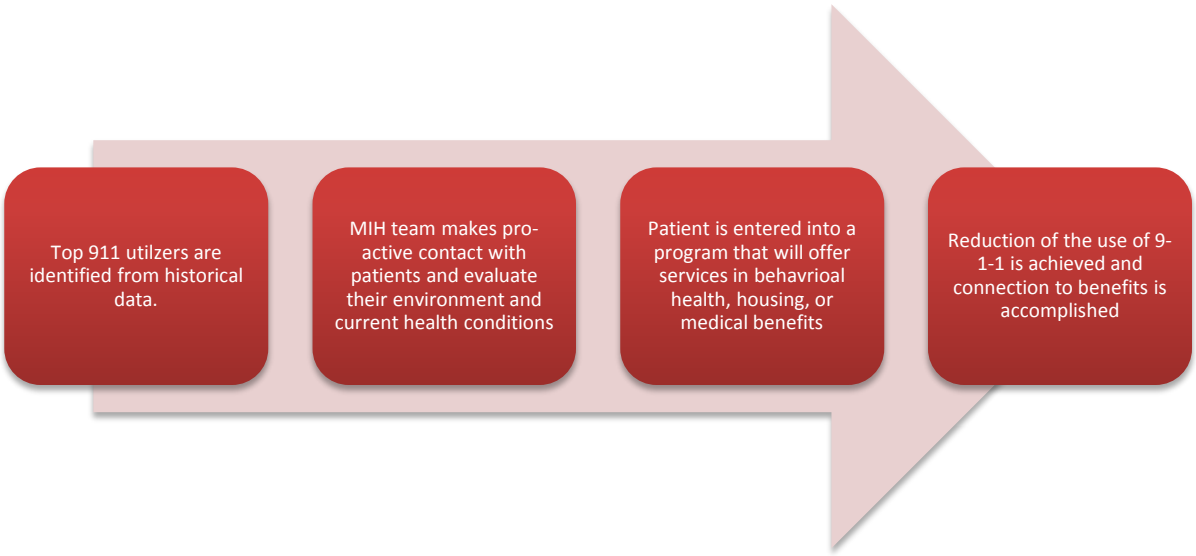

Figure 3. Illustration of MIH Program Response by Colorado Springs and Dallas Fire Departments

IV. FINDINGS AND RECOMMENDATIONS

The findings of this thesis illustrate that the implementation of a MIH program in Sacramento could be effective in providing quality care, increasing the accessibility to healthcare, and decreasing demand of the existing emergency resources. For the department to move forward, stakeholders in healthcare in the Sacramento region must show support and further analysis should be conducted that illustrates the benefits to each party. The hospitals, health plans, clinics, and emergency service providers will need to come to a consensus on a business model to support the endeavor. Stakeholders should identify work groups should to focus attention on fiscal impacts and financial sustainability, program legal implications, technology, and program performance and governance. Also, stakeholders should consider a work group may to address state policy that places limitations on alternative destination transports in medical care.

A. WHAT WILL MIH DO FOR THE SACRAMENTO FIRE DEPARTMENT

By simply conducting a comparative analysis of the results that were achieved from the existing programs, the Sacramento Fire Department can predict the impacts of a MIH program. The department could conduct a comparison by using the same 40 percent achievement of patient care by both Mesa and Anaheim and apply it to the 2016 data from the Sacramento Fire Department. The reduction of the 40 percent is only applied to the low acuity call types that a MIH unit would be dispatched to and is limited by the approximate total number of patient contacts that a MIH car would be able to accomplish in a 10-hour workday. The outcome is illustrated in Table 2.

Table 2. Workload Reduction of MIH Implementation through 9-1-1

SFD Low Acuity Calls 2016	40% Reduction 1 MIH Car	40% Reduction 2 MIH Cars	Low-Acuity Call Reduction	Overall Workload Reduction
2,649 low acuity calls transported to hospital ED	Reduction of 624 transports	Reduction of 624 transports	1,401 fewer transports	3.5%

Table 2 assumes that one MIH car would work a 40-hour workweek. The maximum number of patient contacts a MIH unit can make would be approximately six, utilizing hours in service, time on call lasting approximately one hour as well as cleaning and restocking. The 40 percent reduction is taken from the maximum number of patient contacts per car to be consistent with the success rates of other programs. Additionally, the overall EMS transports for the Sacramento Fire Department for the year 2016 was 40,470.[65] The overall workload reduction is reflective of a 40 percent reduction of calls two MIH cars having the same average success rate would reduce the existing call volume for the Sacramento Fire Department.

This thesis also includes a second comparative analysis from the deployment model used from the Colorado Springs and Dallas Fire Department. Because the Colorado Springs Fire Department focused on such a large population of the 9-1-1 users, this research could not conduct a consistent comparative analysis with data from the Sacramento Fire Department. However, data from the 73 top utilizers of the 9-1-1 system in Sacramento could be identified and the sum of all transports provided to hospital EDs equated to 1,523 for 2016.[66] The Dallas Fire Department reported 83.5 percent reduction in 9-1-1 use from the identified top 73 users of its system.[67] To conduct this comparative analysis, this

[65] Information provide to author by Sacramento Fire Department Records Management System, October 2017.

[66] Ibid.

[67] Public Safety Committee, "Mobile Community Healthcare Program," PowerPoint, Dallas City Hall, April 27, 2015, https://dallascityhall.com/government/Council%20Meeting%20Documents/2015/PS_6_Mobile-Community-Healthcare-Program_Combined_042715.pdf.

research used a direct success rate that Dallas Fire achieved to illustrate the workload reduction for Sacramento Fire. The outcome is illustrated in Table 3.

Table 3. Workload Reduction of MIH Implementation on Target Population

Top 73 Users of 911 for Sacramento Fire in 2016	**Reduction of Calls by Success Rate (Median 83.5%)**	**Overall Workload Reduction**
1,523 ED Transports	Fewer ED Transports 1,272	3.14%

Table 3 illustrates that if the Sacramento Fire Department were to focus its efforts on the specific demographic using the 9-1-1 system the most, the outcome could be 1,272 fewer transports to hospital EDs, an overall reduction in workload of 3.14 percent. This is not only reflective of a reduction in call volume and workload for the existing ambulances, it is also an increase in availability at the hospital EDs. The analysis must consider that the reason the patients are not being transported to a hospital via ambulance is because they have received a better solution for their medical or behavioral health issue. This reduction in workload should also be incremental for this targeted population over a number of years until an anticipated plateau is reached. The program's measures of success are providing quality care, making healthcare accessible, and decreasing the demand of the emergency services.

B. SUSTAINED FUNDING

The existing EMS system nationwide is structured around a very basic business principle. The revenue is created when an ambulance transports a patient to the hospital ED. The patients' health plan covers percentages of the ambulance transport as well as any other services rendered during their stay at the hospital. Fire departments bill the health providers and are reimbursed at a rate consistent with the patients' health plan and coverage. This simple business plan equates to bringing a patient to a hospital ED to generate revenue. This measure does not take into consideration the quality of care or any patient outcomes.

This existing business plan creates a conundrum for any fire department wanting to launch its MIH program independently. The success of its MIH program would mean that a patient receives quality care that is more accessible, but it would also mean that the fire department would not be able to have cost recovery by revenue. In fact, it would be decreasing revenue proportionately to the program's success. Additionally, the hospital ED would see a decrease in low-acuity patients, but it would not necessarily be a cost savings to them. The financial benefit is primarily seen from the health care providers. Several health providers have already begun shifting their programs toward patient outcomes. Hospitals, physician groups, and health providers have increasingly established accountable care organizations (ACO). An ACO is a structure "dedicated to quality and efficiency with the mission and the authority to impose practice, reporting, and compensation standards across a group" representing a specific population of patients.[68] The structure allows for several of the components of a health system to achieve a shared savings if the ACO is meeting performance standards.[69] An established ACO would be a viable shared cost program that could sustain a MIH program in Sacramento and should be explored further.

C. HEALTH INFORMATION EXCHANGE AND INFORMATION TECHNOLOGY

A critical element in providing quality care and making health care more accessible is the ability to have MIH personnel access patient information in the field. A health information exchange (HIE) is the agreement between parties to allow the transfer of protected health information. This patient information must be made available for a midlevel practitioners to make making informed decisions on patients when they are contacted in the field. Information such as patients' medications, physicians, medical history, and the recent visits can all be accessed as long as the hospitals and medical providers agree within a memorandum of understanding in sharing the patients' information.

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[68] Taylor Burke and Sara Rosenbaum, "Accountable Care Organizations," *Law and the Public's Health* 126, no. 6 (2011): 875–878.

[69] Ibid.

The fire departments within Sacramento County have all moved to an electronic patient care reporting system within the last few years. The platforms used do not currently exchange data with the hospitals, but the capability exists. For the inception of an MIH program for Sacramento Fire, the piloted implementation can begin with very high controls and limited access to only the health providers working on the MIH resource. The HIE should not be viewed as a tool that only allows the information to the EMS responder, but also open a more comprehensive set of data that would be essential in care coordination between hospitals, physicians, and clinics. The data shared would be necessary at ensuring that performance achieved throughout the entire healthcare system was in fact providing quality care.

D. FUTURE CONSIDERATIONS

As of September 2017, the Sacramento region finds itself in a unique position of opportunity. Earlier in the year, the city of Sacramento was awarded a grant from the California Department of Health Care Services' Whole Person Care Pilot, authorized under the California Medi-Cal 2020 waiver initiative. The funds through the grant are aimed at building an integrated, countywide system that links housing, behavioral health services, and social service agencies to a more coordinated approach in healthcare delivery. Some of the specific goals set by the city of Sacramento are to provide services to 3,250 individuals over a three-year period and decrease case management loads by 75 percent.[70] The four components of the Sacramento Whole Person Care program are expand existing outreach, create a data system to track patient outcomes, build a robust care management system, and create coordinated housing support.[71] The department is making an effort to incorporate MIH as to establish an HIE for this pilot.

[70] "Mayor Steinberg and City Council Announce $64 Million for Supportive Services in Sacramento," press release, City of Sacramento, June 13, 2017, https://www.cityofsacramento.org/Mayor-Council/Districts/Mayor/Press-Releases/2017-06-15-Whole-Person-Care.

[71] Ibid.

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V. DISCUSSION AND CONCLUSIONS

The purpose of this thesis is to evaluate alternative deployment methods and quantify the impacts of the implementation of MIH and attempt to measure impacts for Sacramento. This thesis's method was developed to measure workload of an existing emergency medical response resource with the anticipation that a MIH program will have a direct effect on resource availability and resilience in response bringing into alignment with a homeland security mission. Specifically, the thesis examined MIH hypothetically implemented and attempt to examine changes in the quality of care provided, increasing the accessibility to healthcare, and finding a way to reduce the demand of the existing emergency medical resources.

A. QUALITY OF CARE

Although no specific metrics were used to show change in quality of care provided by MIH, the program concept by itself allows for quicker treatment of patients in the comfort of their own living environment. The vetting of patients' complaints from the time that they are calling 9-1-1 to request assistance proves to be the most easily deployment model of a pilot MIH program. Once the program moves beyond its pilot phase and can be sustained, a logical enhancement would be to have a nurse practitioner within dispatch. The immediate medical questioning would further allow the appropriate utilization of limited resources and the enhancement could provide efficiency to the existing MIH resources being deployed by more accurately triaging patients' needs.

The logical next step beyond a pilot program of MIH would be to find program sustainability. Examples of models with program sustainability are often through a shared governance model that is established through an ACO. The Sacramento area is a healthcare rich environment with many hospitals, physicians' groups, health care providers, and clinics. Bringing the resources together for quality of care of patient populations would be in the best interest of all stakeholders. A shared governance ACO would also bring many organizations in alignment with the trend of further incentivizing patient outcome based care.

B. MAKING HEALTHCARE ACCESSIBLE

This research illustrates that a large portion of the population has turned to EMS as their primary health care provider. Research and several reports illustrate the consequences that occur when an EMS system is used in this fashion and the resulting undesirable impacts. In lieu of public education campaigns to sway the public's use of the EMS system, the healthcare system has shown need to evolve with the creation of MIH. Bringing the option of low acuity care directly to those who are requesting EMS in their living environment has proven to be a valid solution. All of the MIH programs this study reviewed did have educational components and capabilities of evaluating a person's living environment to increase a person's overall health. Existing programs also have capability to make sure other services, such as housing, primary care health, behavioral health, employment support, and benefits counseling are all made available to patients. These additional services have a success rate of improving the overall health of an individual and can accomplish the goal of MIH.

C. REDUCING THE DEMAND OF EXISTING EMERGENCY MEDICAL RESOURCES

This study's predictive analysis is narrow in scope due to the limited number of existing MIH programs and how recent they have been introduced. Every program evaluated for this thesis had a stated goal of increasing the availability of their emergency response resources. Programs that added the additional resource into the emergency response system, or by intervening with the top users of the 9-1-1 system, accomplished this goal to varying degrees. This research ascertained an increase of availability by a cross comparison of the type of calls the Sacramento Fire Department is currently running with its existing population to the levels of success other departments have achieved. Program leaders should monitor performance and room for the program to grow beyond the initial pilot program implementation.

As illustrated in this study, there are several influences that have caused a large population to utilize emergency services for non-emergent needs and any adjustments in new care delivery will be affected by a myriad of changes from legislation in healthcare,

the economy, or microeconomic trends only affecting individual organizations in Sacramento. At present, the data illustrates that a MIH program serving the Sacramento area would begin to increase the availability of the existing ambulances. Although nominal in its concept, the EMS resources are scarce throughout the nation due to the problem of saturation and programs being run in a classic business model where system demand dictates revenue and only the resources that can be afforded are offered. The implementation of MIH in Sacramento can serve as a test bed of an improved healthcare model that adds resilience to the emergency medical services and resources identified as critical infrastructure and key resources in the nations national response framework.

D. "ALL MODELS ARE WRONG; SOME ARE USEFUL"

In a 1976 publication of the *Journal of the American Statistical Association*, George Box declared that all models are theoretically wrong. In his article, he is noted as stating, "Since all models are wrong, the scientist cannot obtain a correct one by excessive elaboration."[72] He went on further to state, "the ability to devise simple but evocative models is the signature of the great scientist so overelaboration and over parameterization is often the mark of mediocrity."[73] The model presented in this thesis work is not elaborate; it is simple enough to sufficiently state that MIH will improve the efficiency in the use of the existing emergency medical resources. The models also give insight to two different approaches and illustrate what the predicted outcomes would possibly mean toward achieving the goal of resource availability. This model should be applied and re-applied to account for progress. Because MIH is a prescriptive plan providing solutions to a specific population, there is a balance that needs to be found on the number of resources versus the number of traditional emergency response ambulances a given community should have. One can assume that there will always be a need for both, but each resource has a symbiotic relation to the other, which helps them successfully exist.

[72] George E. P. Box, "Science and Statistics," *Journal of the American Statistical Association* 71, no. 356 (1976): 791–799, http://www-sop.inria.fr/members/Ian.Jermyn/philosophy/writings/Boxonmaths.pdf.

[73] Ibid.

As MIH models continue to evolve into specifically tailored programs to meet the needs of the populations served, a consistent set of performance measures should be applied to continuously evaluate and quantify progress. Like most complex systems, the application of a solution can often create unpredictable and undesirable outcomes. The performance measures of MIH should be in alignment with the existing measures in use by the ACA and take into consideration how to best integrate healthcare systems. Prior to implementing a full MIH program, a needs assessment should address any gaps in a community's health care system. The performance measures based on outcomes should assess the quality of care, frequency of utilization, as well as a community health needs assessment. The progress should indicate both increased program enrollment as well as metrics indicating the overall health of the community. The performance of existing EMS resources and what impacts MIH will have on their availability to respond to the community's emergencies are metric that program administrators should continually examine. With an evolving healthcare system, which will have several iterations of refinement, the connection to the future of EMS and resiliency should be on the forefront of homeland security practitioner's agenda.

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